

Zero-Drift, Single-Supply, Rail-to-Rail Input/Output Operational Amplifier

Preliminary

AD8551/52/54

FEATURES

Low Offset Voltage: 5 μV Input Offset Drift: 0.03 μV/°C Rail-to-Rail Input and Output Swing 5 V Single-Supply Operation High Gain, CMRR, PSRR: 120 dB Ultra Low Input Bias Current: 20 pA Low Supply Current: 650 μA/op amp Overload Recovery Time: 2 ms No External Components Required

APPLICATIONS

Automotive Sensors
Pressure and Position Sensors
Strain Gage Amplifiers
Medical Instrumentation
Thermocouple Amplifiers

GENERAL DESCRIPTION

This new family of amplifiers has ultra-low offset, drift and bias current. The AD8551, AD8552 and AD8534 are single, dual, and quad amplifiers featuring rail-to-rail input and output swings. All are guaranteed to operate from 2.7 to 5 volts single supply.

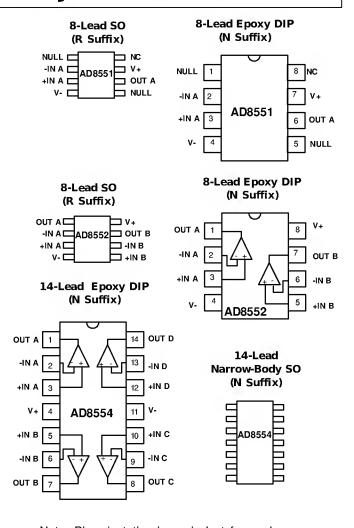
The AD855x family provides the benefits previously found only in expensive auto-zeroing or chopper-stabilized amplifiers. Using Analog Devices' new topology these new zero-drift amplifiers combine low cost, with high accuracy. (No external capacitance is required.)

With an offset voltage of only $5\mu V$ and drift less than $0.03\mu V/^{\circ}C$, the AD8551 is perfectly suited for applications where error sources cannot be tolerated. Position and pressure sensors, medical equipment, and strain gage amplifiers benefit greatly from nearly zero drift over their operating temperature range. Many more systems require the rail-to-rail input and output swings provided by the AD855x family.

The AD8551/52/54 family is specified for the extended industrial (-40° to +125°C) temperature range. The AD8551 single and AD8552 dual amplifiers are available in 8-pin plastic DIP and SO surface mount packages. The AD8554

REV. 0

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Note: Pin orientation is equivalent for each package variation quad is available in the 14-pin DIP, and narrow 14-pin packages.

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$\begin{tabular}{ll} \textbf{ELECTRICAL SPECIFICATIONS} \ (@\ V_S = +5.0V,\ V_{CM} = 0.1V,\ V_O = 1.4V,\ T_A = +25^{\circ}C\ unless\ otherwise\ specified.) \end{tabular}$

Parameter		Symbol	Conditions	Min	Тур	Max	Units
INPUT CHARACTE	ERISTICS						
Offset Voltage	AD8551	V _{OS}			1	5	μV
			-40 °C $\leq T_A \leq +125$ °C			10	μV
	AD8552/54	V _{OS}			1	8	μV
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$			12	μV
Input Bias Current		I_B			20	50	pA
•			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$			60	pA
Input Offset Current	t	I _{OS}	A		10	40	pA
		-03	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$			50	nA
Input Voltage Range	<u>a</u>		10 0 1 1A 1 120 0	0		5	V
Common-Mode Reje		CMRR	$V_{CM} = 0$ to 4.9V	110	130		dB
3			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$	100	120		dB
Large Signal Voltag	e Gain (Note 1)	A _{VO}	$R_L = 10 \text{ k}\Omega$, Vo=0.3 to 4.7V	110	120		dB
zurge orginar vortug	(1 (0 to 1)	7100	$-40^{\circ}\text{C} \le \text{T}_{A} \le +125^{\circ}\text{C}$	100	120		dB
Offset Voltage Drift		$\Delta V_{OS}/\Delta T$	$-40^{\circ}\text{C} \le T_{A} \le +125^{\circ}\text{C}$ $-40^{\circ}\text{C} \le T_{A} \le +125^{\circ}\text{C}$	100	0.02	0.04	μV/°C
Bias Current Drift	•		-70 C 2 1A 2 T123 C		0.02	0.04	μν/ C pA/°C
		$\Delta I_{\rm B}/\Delta T$					_
Offset Current Drift		$\Delta I_{OS}/\Delta T$					pA/°C
OUTPUT CHARAC		***	D 1001 O . C		4.05		X7
Output Voltage High		V_{OH}	$R_{\rm L} = 100 {\rm k}\Omega$ to Ground		4.95		V
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$				V
			$R_L = 10k\Omega$ to Ground		4.9		V
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$				V
Output Voltage Low	/	V_{OL}	$R_L = 100 k\Omega$ to V+		50		mV
			-40 °C $\leq T_A \leq +125$ °C				mV
			$R_L = 10 \text{ k}\Omega \text{ to V+}$		100		mV
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$				mV
Short Circuit Limit		I_{SC}		± 25	± 30		mA
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$		± 20		mA
Output Current		I_{O}		± 8			mA
•			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$	± 5			mA
POWER SUPPLY			A	1			
Power Supply Rejec	etion Ratio	PSRR	$V_S = 2.7V \text{ to } 5.5V$	110	130		dB
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$	100	110		dB
Supply Current/Amp	plifier	I _{SY}	$V_O = 0V$		600		μA
ppij Carronorinij	P	-5 Y	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$		700		μΑ
DYNAMIC PERFO	DMANCE				, 00		μ. ι
Slew Rate	NIVIAINCE	SR	$R_{\rm L} = 10 \text{ k}\Omega$		0.8		V/µs
Overload Recovery	Time	SIX.	KL =10 K32		2	5	ms
Gain Bandwidth Pro		GBP			1.5		MHz
NOISE PERFORMA		OD!			1.5		1,111
Voltage Noise	II (CL	e	0.1 to 10 Hz		1.3		μV _{p-p}
Voltage Noise		e _{n p-p}	0.1 to 1.0 Hz		0.4		μV _{p-p}
Voltage Noise Densi	itv	e _{n p-p}					μν _{p-p} nV/√Hz
Current Noise Densi	=	e _n	f = 1 kHz		TBD		pA/√Hz
Nata 1. Cain tastis	=	in	f=10 Hz		TBD		PEN VIII

Note 1: Gain testing is highly dependent upon test bandwidth.

Preliminary

AD8551/251/451

$\textbf{ELECTRICAL SPECIFICATIONS} \ (@\ V_S = +3.0V,\ V_{CM} = 0.1V,\ V_O = 1.4V,\ T_A = +25^{\circ}C\ unless\ otherwise\ specified.)$

Parameter		Symbol	Conditions	Min	Тур	Max	Units
INPUT CHARACTE	ERISTICS						
Offset Voltage	AD8551	V _{OS}			1	5	μV
			-40 °C $\leq T_A \leq +125$ °C			10	μV
	AD8552/54	V _{OS}			1	8	μV
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$			12	μV
Input Bias Current		I_{B}			20	50	pA
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$			60	pA
Input Offset Current		I_{OS}			10	40	pA
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$			50	nA
Input Voltage Range				0		5	V
Common-Mode Reje	ection Ratio	CMRR	$V_{CM} = 0$ to 2.9V	110	130		dB
J			-40 °C $\leq T_A \leq +125$ °C	100	120		dB
Large Signal Voltag	e Gain	A_{VO}	$R_L = 10 \text{ k}\Omega$, Vo=0.3 to 4.7V	110	120		dB
C 1 6			-40 °C \leq T _A \leq +125°C	100			dB
Offset Voltage Drift		$\Delta V_{OS}/\Delta T$	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$		0.02	0.04	μV/°C
Bias Current Drift		$\Delta I_B/\Delta T$	11				pA/°C
Offset Current Drift		$\Delta I_{OS}/\Delta T$					pA/°C
OUTPUT CHARAC		0.3					1
Output Voltage High		V _{OH}	$R_{\rm L} = 100 \text{k}\Omega$ to Ground		2.9		v
		OII	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$				V
			$R_L = 10k\Omega$ to Ground		2.75		V
			$-40^{\circ}\text{C} \leq \text{T}_{\text{A}} \leq +125^{\circ}\text{C}$		2.,0		V
Output Voltage Low	,	V _{OL}	$R_L = 100k\Omega$ to V+		100		mV
Output Voltage Low		OL	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$		100		mV
			$R_L = 10 \text{ k}\Omega \text{ to V} +$		250		mV
			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$		230		mV
Short Circuit Limit		T	-40 C S 1 _A S +123 C				mA
Short Cheuit Linnt		I_{SC}	40°C < T < +125°C	±	± .		
Output Cumont		т.	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$	1.5	±		mA
Output Current		I_{O}	40°C < T < .125°C	± 5			mA
DOLLED GLIDDLY			$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$	±			mA
POWER SUPPLY	dian Dadia	DCDD	N 27N to 55 N	110	120		dD.
Power Supply Rejec	uon Kauo	PSRR	$V_S = 2.7V \text{ to } 5.5 \text{ V}$	110	130		dB
6 1 . 6	.1101	т.	$-40^{\circ}\text{C} \le \text{T}_{\text{A}} \le +125^{\circ}\text{C}$	100	110		dB
Supply Current/Amp	piitier	I_{SY}	$V_O = 0V$		200		μA
			$-40^{\circ}\text{C} \leq \text{T}_{\text{A}} \leq +125^{\circ}\text{C}$		250		μΑ
DYNAMIC PERFO	RMANCE	(ID	D 1010		0.5		***
Slew Rate	T.'	SR	$R_L = 10 \text{ k}\Omega$		0.5		V/µs
Overload Recovery Time		CDD			2		ms MHz
Gain Bandwidth Pro		GBP			1		MHz
NOISE PERFORMA Voltage Noise	AINCE	A	0.1 to 10 Hz		TBD		uV
-	itsy	e _{n p-p}					μV _{p-p} nV/√Hz
Voltage Noise Density		e _n	f = 1 kHz		TBD		nv/vHz pA/√Hz
Current Noise Density		1 _n	f=10 Hz		TBD		p <i>A</i> v vnz

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ABSOLUTE MAXIMUM RATINGS

Supply Voltage	+6V
Input Voltage	
Differential Input Voltage ¹	±5.0V
Output Short-Circuit Duration to Gnd	Indefinite
Storage Temperature Range	
N, R Package	65°C to +150°C
Operating Temperature Range	
AD8551/52/54A	40°C to +125°C
Junction Temperature Range	
N, R Package	65°C to +150°C
Lead Temperature Range (Soldering, 10 sec	c)+300°C

Package Type	θ_{JA}^2	θЈС	Units	
8-Pin Plastic DIP (N)	103	43	°C/W	
8-Pin SOIC (R)	158	43	°C/W	
14-Pin Plastic DIP (N)	76	33	°C/W	
14-Pin SOIC(R)	120	36	°C/W	

NOTES

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8551AN	-40°C to +125°C	8-Pin Plastic DIP	N-8
AD8551AR	-40°C to +125°C	8-Pin SOIC	SO-8
AD8552AN	-40°C to +125°C	8-Pin Plastic DIP	N-8
AD8552AR	-40°C to +125°C	8-Pin SOIC	SO-8
AD8554AN	-40°C to +125°C	14-Pin Plastic DIP	N-14
AD8554AR	-40°C to +125°C	14-Pin SOIC	SO-14

APPLICATIONS

 $^{^{1}}$ Differential input voltage is limited to ±5.0 volts or the supply voltage, whichever is less.

 $^{^2}$ θ_{JA} is specified for the worst case conditions, i.e., θ_{JA} is specified for device in socket for P-DIP packages; θ_{JA} is specified for device soldered in circuit board for SOIC and TSSOP packages.